Osawatomie, KS
Mitigation Planning Technical Assistance

Pottawatomie Creek Flood Forecasting Using Lane Gage

February 14, 2020

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Agenda

1. Introductions
2. Meeting Objectives
3. Project Review - Technical Memo
4. Results – Open Discussion

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Introductions

FEMA Region VII

- Andy Megrail, GIS Project Manager
- Dawn Livingston, Risk Analyst

U.S. Army Corps of Engineers

- Allen Chestnut, Senior Hydrologic Engineer
- Jennifer Wood, Levee Safety Program Manager

Kansas Department of Agriculture-Div. of Water Resources

- Steve Samuelson, NFIP Coordinator
- Tara Lanzrath, Floodplain Mapping Coordinator
- Joanna Rohlf, Floodplain Mapping Specialist
- Bill Pace, Floodplain Mapping Specialist

Stantec

- Anish Pradhananga, Senior Engineer
- Chunyan Li, Engineer in Training
- Will Zung, Project Manager

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Meeting Objectives

- Gain understanding of methodology of forecasting floods at locations downstream of gages.
- Have awareness of the hydrologic and hydraulic modeling applied for the flood forecasting at the levee.
- Understand the results in flood forecasting tables
- Understand how these tables combined with the stream gage forecasts can be used as reference for decisions by the city

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Project Review

Kansas
Department of Agriculture
Division of Water Resources

Stantec

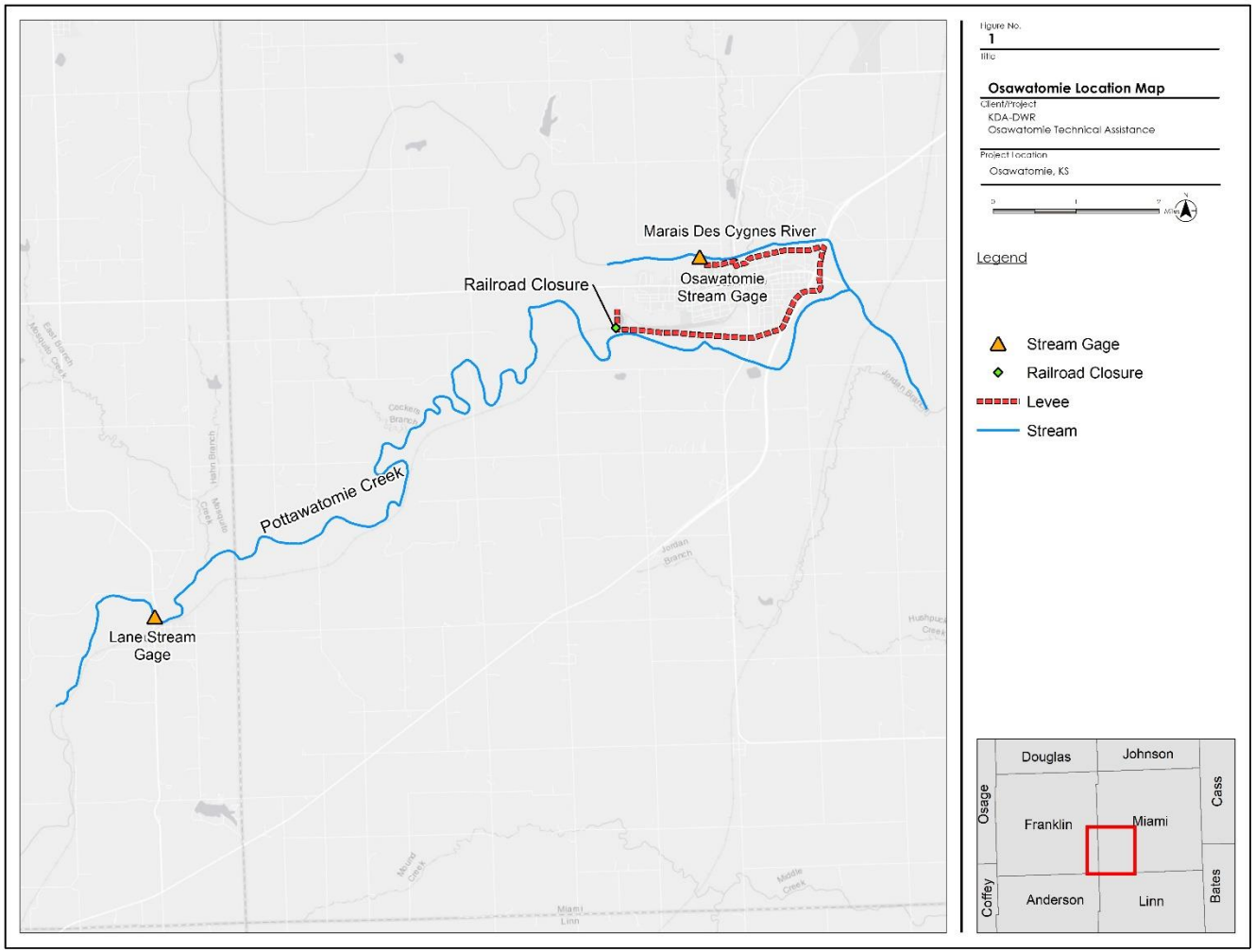
Technical Analysis

- Research Flood Forecasting Methodology
  - Flood Inundation Mapping (FIM) Program
  - Recommended Methodology
- Hydrologic Analysis
  - Hydrograph Development
- Hydraulic Analysis
  - Model Development
  - Model Calibration
- Flood Forecasting
  - Methodology

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Technical Analysis – Study Area

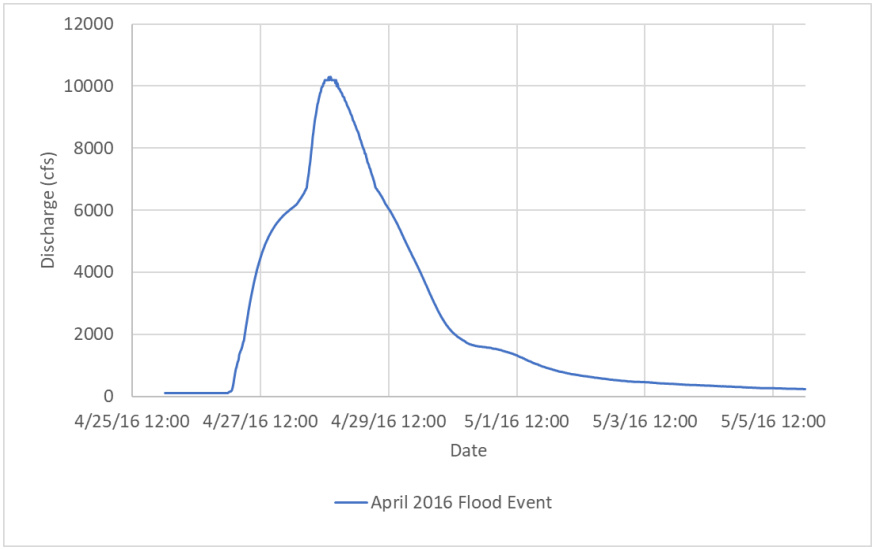


Kansas
Department of Agriculture
Division of Water Resources

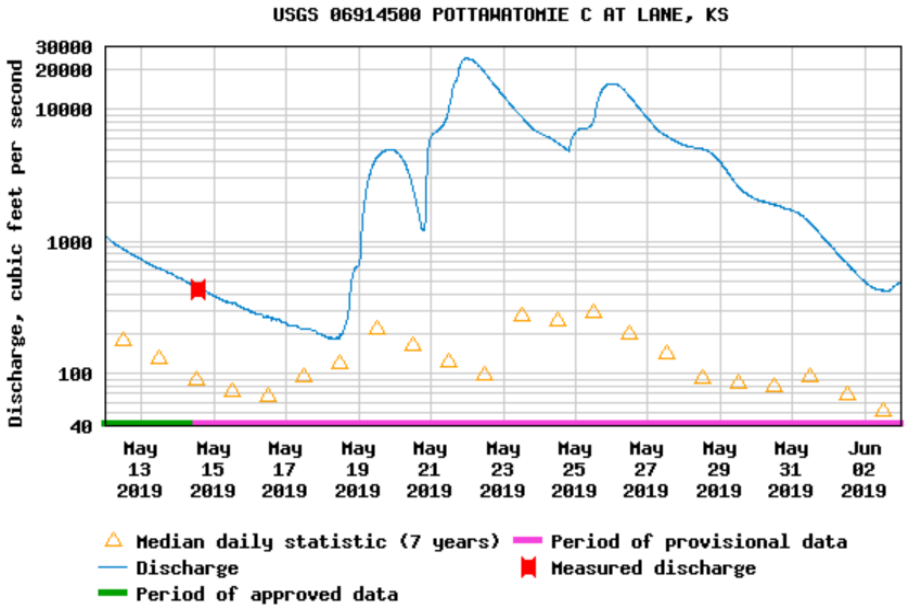
Stantec

Technical Analysis – Hydrology

Pottawatomie Creek: USGS 06914500 at Lane, KS



April 2016 hydrograph



May 2019 hydrograph

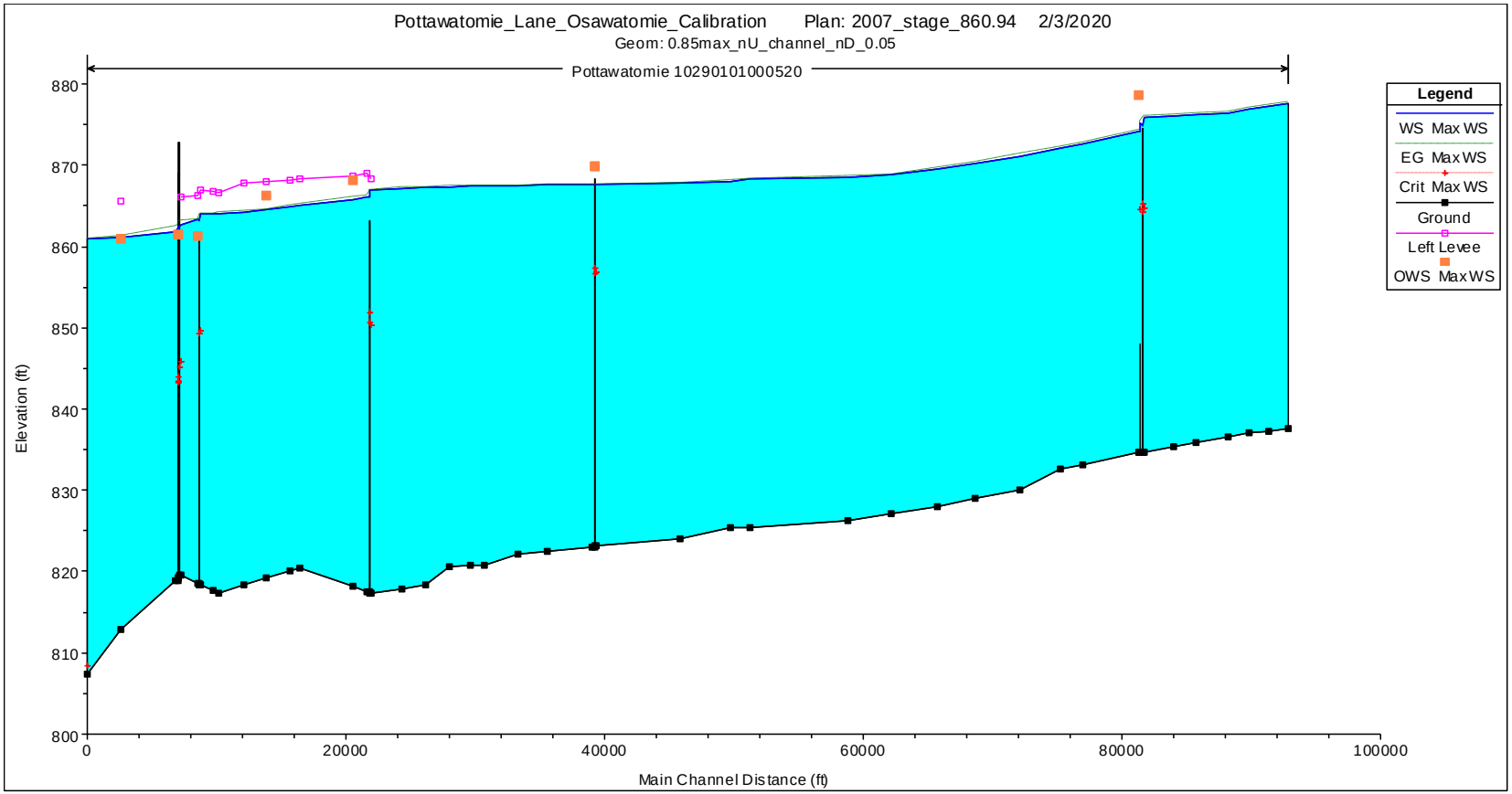
Kansas Department of Agriculture
Division of Water Resources

Stantec

Technical Analysis

Calibration to 2007 Flood Event-High Water Marks

peak flow of 80,000 cfs, stage hydrograph of 860.94 ft BC



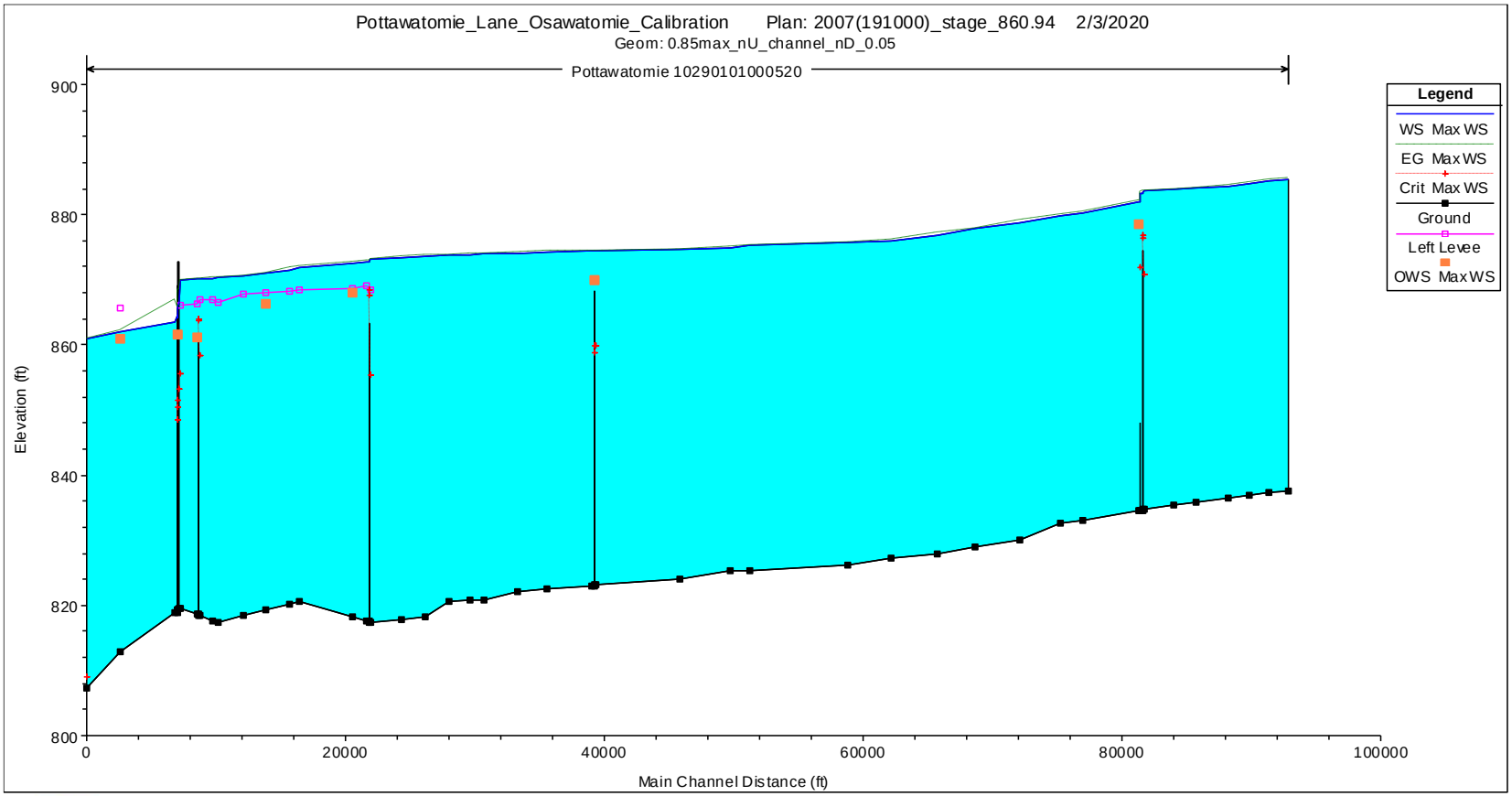
Kansas Department of Agriculture
Division of Water Resources

Stantec

Technical Analysis

Calibration to 2007 Flood Event-High Water Marks

peak flow of 190,000 cfs, stage hydrograph of 860.94 ft BC



Kansas Department of Agriculture Division of Water Resources

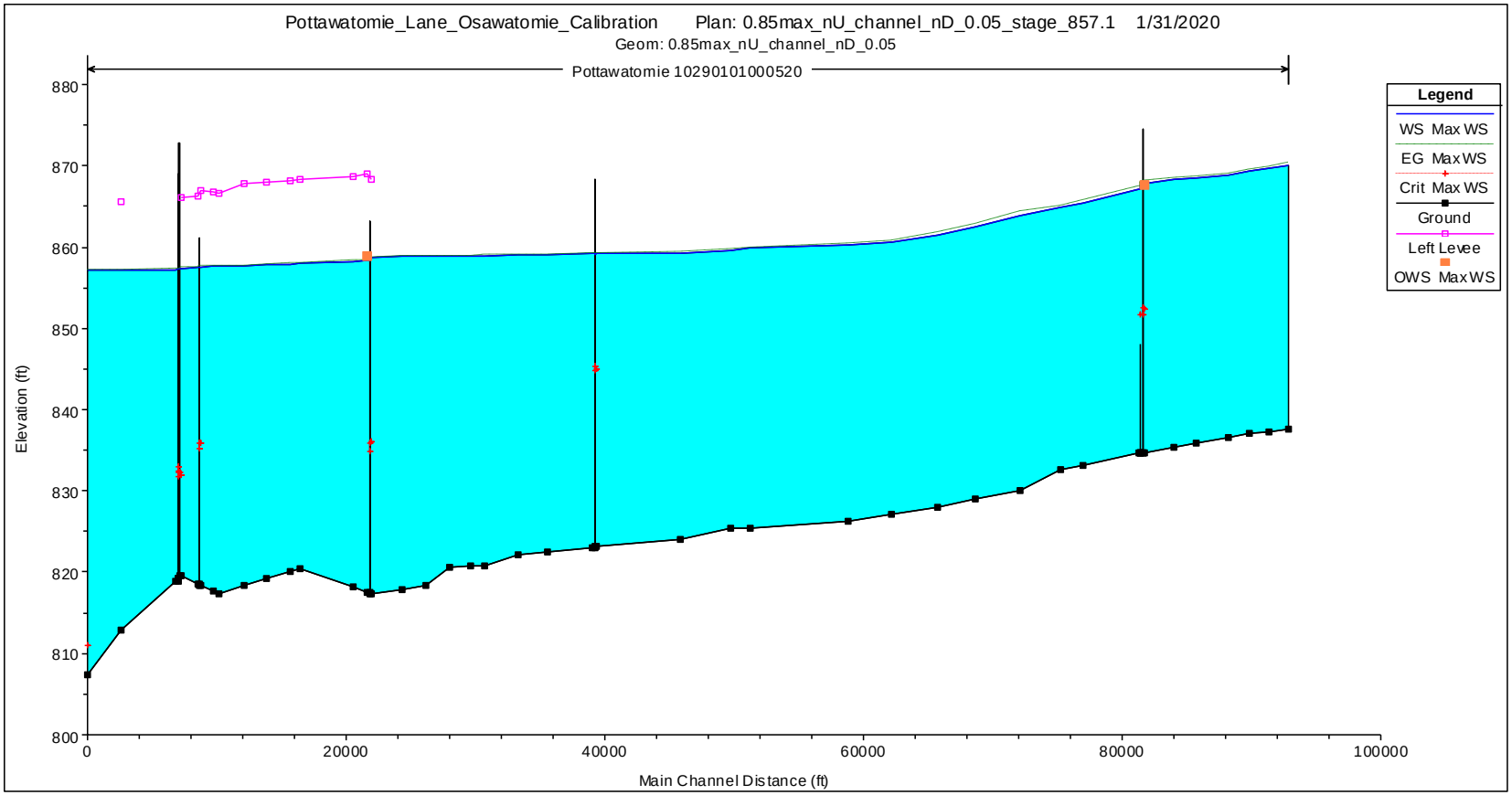
Stantec

Technical Analysis
Calibration to May 2019 Flood Event

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Technical Analysis
Calibration to May 2019 Flood Event



Kansas Department of Agriculture
Division of Water Resources

Stantec

Results

Review Flood Forecasting Tables

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Review the Flood Forecasting Tables

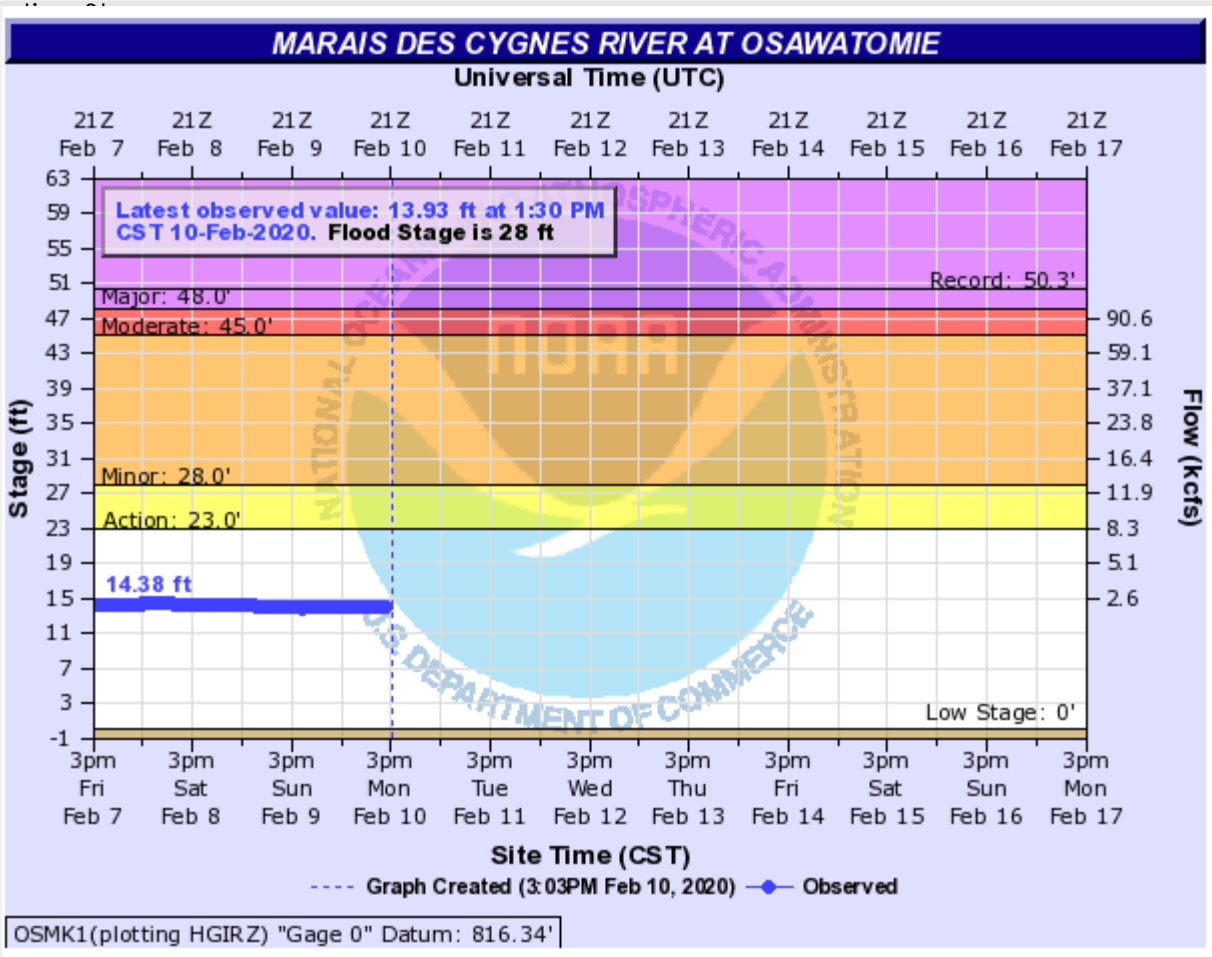
- This is the community's opportunity to review the tables.
- Questions to consider:
  - What are the potential scenarios for the flood forecasting boundaries at Lane gage and Osawatomie gage?
  - What are the peak water surface elevations at railroad closure invert and when the peak will reach?
  - When will the water surface elevations reach the railroad closure invert elevation and what are the flows?

Kansas
Department of Agriculture
Division of Water Resources

Stantec

Scenario Analysis

Stage (ft) at Osawatomie	Flood Categories
23	A
28	Fl
36	S
40	S
41.5	S
46	S
51	Tl

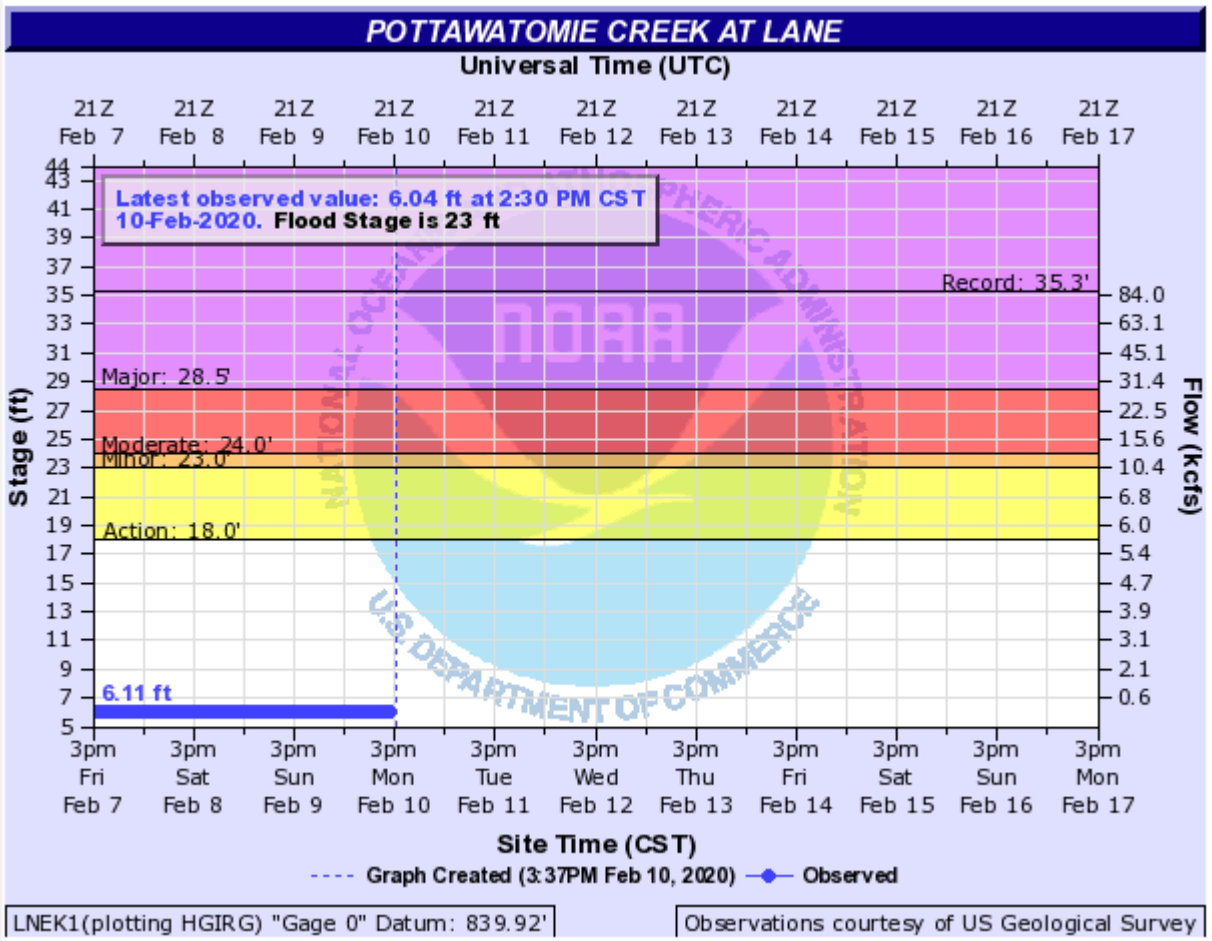


Kansas Department of Agriculture
Division of Water Resources

Stantec

Scenario Analysis

Stage (ft) at Lane	Flood Categories
18.0	Ac
23.0	Fl
24.0	M
25.0	Cl
27.0	No
28.5	M
31.2	W
35.3	Re
36.0	W
37.0	Fl



Kansas Department of Agriculture
Division of Water Resources

Stantec

Reviewing the Tables

Peak WSE and Arrival Time (hours) at RR Closure

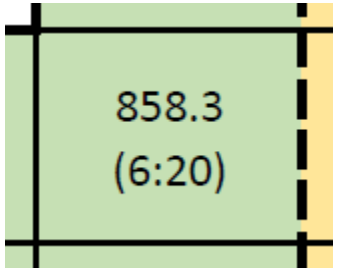
Appendix A: Peak water surface elevation (ft) and arrival time (hr) at railroad closure invert* for different stage combinations at Lane and Osawatomie gag

MDC Lane / Stage (ft)	Stage (ft) / Elevation (ft)	23.0	28.0	36.0	40.0	41.5	43.0	46.0	51.0
	Stage (ft) / Elevation (ft)	839.8	844.8	852.8	856.8	858.3	859.8	862.8	867.8
18.0	858.4	842.5 (3:20)	844.3 (3:00)	850.7 (2:35)	855.3 (2:10)	857.0 (2:25)	8.7*** (0:00)	862.2*** (0:00)	
23.0	863.4	847.8 (8:15)	848.4 (8:05)	851.8 (7:05)	855.6 (4:50)	857.3 (3:55)	858.9 2:50)	862.3 (0:40)	
24.0	864.4	848.8 (9:20)	849.1 (9:00)	852.3 (8:00)	855.8 (5:40)	857.4 (4:30)	859.0 3:30)	862.3 (1:15)	867.5*** (0:00)
25.0	865.4	850.1 (9:50)	850.4 (9:40)	852.7 (8:20)	856.0 (6:15)	857.6 (5:25)	859.1 4:20)	862.5 (2:35)	
27.0	867.4	852.4 (9:30)	852.5 (9:20)	854.0 (8:25)	856.7 (7:05)	858.0 (6:25)	859.5 5:25)	862.6 (2:55)	
27.5	867.9	853.3 (9:15)	853.4 (9:00)	854.7 (8:20)	857.1 (7:00)	858.3 (6:20)	859.7 5:35)	862.8 (3:35)	
28.5	868.9	854.0 (9:00)	854.1 (8:45)	855.0 (8:20)	857.3 (7:05)	858.5 (6:25)	859.9 5:45)	862.9 (3:40)	868.2 (0:40)
30.0	870.4	856.0 (8:25)	856.0 (8:15)	856.6 (7:55)	858.4 (7:15)	859.4 (6:45)	860.6 6:00)	863.3 (4:05)	868.3 (1:15)
31.2	871.6	857.7** (8:00)		858.2 (7:30)	859.6 (6:55)	860.4 (6:30)	861.4 5:55)	863.7 (4:25)	**868.5 (1:45)**
32.0	872.4	858.7** (7:05)		858.7 (7:25)	859.9 (6:50)	860.7 (6:30)	861.6 5:50)	863.8 (4:25)	**868.6 (1:50)**
33.0	873.4	860.3** (7:05)		860.6 (6:50)	861.6 (6:10)	862.2 (5:50)	863.0 5:30)	864.7 (4:20)	**868.9 (2:05)**
35.3	875.7	864.0** (5:50)		864.1 (5:35)	864.7 (5:25)	865.1 (5:30)	865.8 4:45)	866.4 (3:15)	**869.6 (1:50)**
36.0	876.4	864.7** (5:40)		864.7 (5:30)	865.3 (5:10)	865.8 (5:35)	866.1 4:05)	866.6 (3:10)	**869.8 (1:55)**
37.0	877.4	866.5** (5:35)		866.7 (5:35)	867.1 (4:35)	867.1 (4:00)	867.1 3:35)	867.7 (3:20)	**870.2 (2:05)**

No flooding at the railroad closure | Water within 2.0 ft below railroad closure invert | Water overtops railro- closure invert | evee overtopping at railroad closure

*Railroad closure invert elevation of 858.7 ft NAVD88 is stage 0.0 ft.
**Under conditions of high flow at Lane and low stage at Osawatomie, normal depth was used as downstream boundary condition.
***Under conditions of low flow at Lane and high stage at Osawatomie, the stage at Lane would be higher than expect. The water surface elevation at the flood start time was reported for these scenarios.

May 2019 Event



Kansas Department of Agriculture
Division of Water Resources

Stantec

Reviewing the Tables

Peak Stage and Arrival Time (hours) at RR Closure

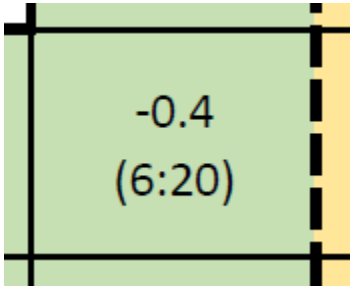
Appendix B: Peak stage (ft) and arrival time (hr) at railroad closure invert* for different stage combinations at Lane and Osawatomi

MDC (ft) / Lane (ft)	23.0	28.0	36.0	40.0	41.5	43.0	46.0	51.0
18.0	-16.2 (3:20)	-14.4 (3:00)	-8.0 (2:35)	-3.4 (2:10	-1.7 (2:25)	.0*** :00)	3.5*** (0:00)	
23.0	-10.9 (8:15)	-10.3 (8:05)	-6.9 (7:05)	-3.1 (4:50	-1.4 (3:55)	0.2 2:50)	3.6 (0:40)	
24.0	-9.9 (9:20)	-9.6 (9:00)	-6.5 (8:00)	-2.9 (5:40	-1.3 (4:30)	0.3 2:50)	3.6 (1:15)	8.8*** (0:00)
25.0	-8.6 (9:50)	-8.3 (9:40)	-6.1 (8:20)	-2.7 (6:15	-1.2 (5:25)	0.4 4:20)	3.8 (2:35)	
27.0	-6.3 (9:30)	-6.2 (9:20)	-4.7 (8:25)	-2.0 (7:05	-0.7 (6:25)	0.8 5:25)	3.9 (2:55)	
27.5	-5.4 (9:15)	-5.3 (9:00)	-4.0 (8:20)	-1.6 (7:00	-0.4 (6:20)	1.0 5:35)	4.1 (3:35)	
28.5	-4.7 (9:00)	-4.7 (8:45)	-3.7 (8:20)	-1.4 (7:05	-0.2 (6:25)	1.2 5:45)	4.2 (3:40)	5.3 (0:40)
30.0	-2.7 (8:25)	-2.7 (8:15)	-2.1 (7:55)	-0.3 (7:15	0.7 (6:45)	1.9 6:00)	4.6 (4:05)	9.6 (1:15)
31.2	-1.0** (8:00)		-0.5 (7:30)	0.9 (6:55	1.7 (6:30)	2.7 5:55)	5.0 (4:25)	**9.8 (1:45)**
32.0	0.0** (7:05)		0.0 (7:25)	1.2 (6:50	2.0 (6:30)	3.7 5:50)	5.1 (4:25)	**9.9 (1:50)**
33.0	1.6** (7:05)		1.9 (6:50)	2.9 (6:10	3.5 (5:50)	4.3 5:30)	6.0 (4:20)	**10.2 (2:05)**
35.3	5.3** (5:50)		5.4 (5:35)	6.0 (5:25	6.4 (5:30)	7.1 4:45)	7.6 (3:15)	**10.9 (1:50)**
36.0	6.0** (5:40)		6.0 (5:30)	6.6 (5:10	7.0 (5:35)	7.4 4:05)	7.9 (3:10)	**11.1 (1:55)**
37.0	7.8** (5:35)		8.0 (5:35)	8.4 (4:35	8.4 (4:00)	8.4 3:35)	9.0 (3:20)	**11.5 (2:05)**

No flooding at the railroad closure	Water within 2.0 ft below railroad closure invert	Water overtops railroad closure invert	**Levee overtopping at railroad closure**

*Railroad closure invert elevation of 858.7 ft NAVD88 is stage 0.0 ft.
**Under conditions of high flow at Lane and low stage at Osawatomie, normal depth was used as downstream boundary condition.
***Under conditions of low flow at Lane and high stage at Osawatomie, the stage at Lane would be higher than expect. The water surface elevation at the flood start time was reported for these scenarios.

May 2019 Event



Kansas Department of Agriculture
Division of Water Resources

Stantec

Reviewing the Tables

Flow and Arrival Time (hours)to RR Closure Invert

Appendix C: Pottawatomie Creek discharge (kcfs) and arrival time (hr) to reach the railroad closure invert* for different stage combination at Lane and Osawatomie gages

MDC Lane / Stage (ft)	Stage (ft)	23.0	28.0	36.0	40.0	41.5	43.0	46.0	51.0
Stage (ft)	Elevation (ft)	839.8	844.8	852.8	856.8	858.3	859.8	862.8	867.8
18.0	858.4						0.0*** (0 kcfs) (0:00)	3.5*** (0 kcfs) (0:00)	8.8*** (0 kcfs) (0:00)
28.0	868.4					0.0 (27 kcfs) (5:30)			
29.8	870.2				0.0 (36 kcfs) (6:50)				
31.3	871.7			0.0 (44 kcfs) (8:10)					
31.6	872.0	0.0** (46 kcfs) (8:25)							

No flooding at the railroad closure	Water within 2.0 ft below railroad closure invert	Water at railroad closure invert	Water above railroad closure invert

*Railroad closure invert elevation of 858.7 ft NAVD88 is stage 0.0 ft.

**Under conditions of high flow at Lane and low stage at Osawatomie, normal depth was used as downstream boundary condition.

***Under conditions of low flow at Lane and high stage at Osawatomie, the stage at Lane would be higher than expect. The water surface elevation at the flood start time was reported for these scenarios.

Kansas Department of Agriculture
Division of Water Resources

Stantec

Questions and Answers

Have We Answered All Your Questions?

Kansas
Department of Agriculture
Division of Water Resources

Stantec